Statewide Fisheries Management Plan Supplement:

Recent Trout Population Trends and Angling Pressure Estimates for the Middle Clark Fork River

Introduction

The 'middle Clark Fork River' is defined as the main stem reach from the mouth of Rock Creek downstream to the Flathead River confluence in west-central Montana. This 136-mile section includes the greater Missoula Valley, as well as major river junctions at the mouths of the Blackfoot, Bitterroot and St Regis Rivers (see Figure 1). Although not as intensive as other neighboring rivers in FWP Region 2, angling and recreational pressure are high on the middle Clark Fork River.

Trout population estimate sections were established in many reaches along the middle Clark Fork River main stem in the 1980s. However, sampling effort over the last two decades has focused on reaches in the upper half of the project area. Prioritization of upper sampling reaches reflects the importance of monitoring fish population response following the removal of Milltown Dam/Reservoir and other factors (Schmetterling 2014). The dam was located immediately below the mouth of the Blackfoot River near East Missoula. Sampling sections referenced in this document reflect trout abundance trends in reaches below confluences with the Blackfoot and Bitterroot Rivers located just upstream and downstream of Missoula, respectively (see Figure 1 Map).

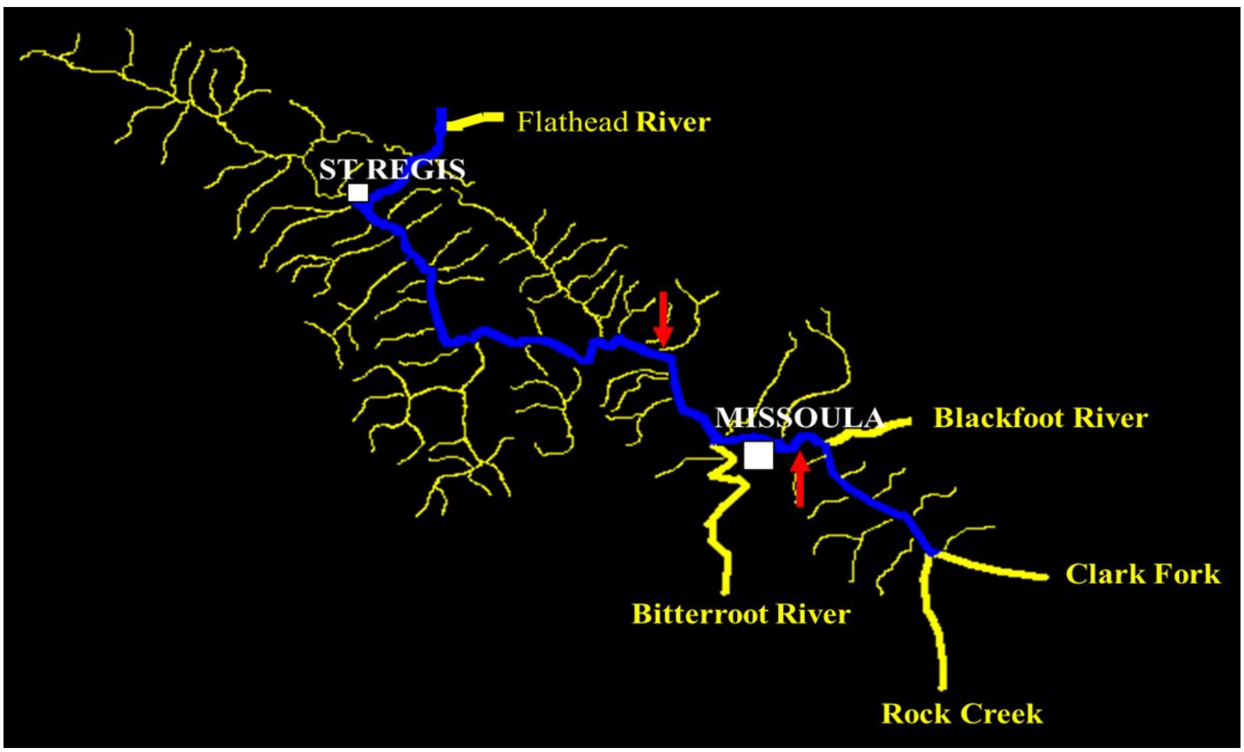

Figure 1. Map of Middle Clark Fork River basin, with main stem reach highlighted in blue and the locations of trout population estimate sections (Milltown & Huson) indicated by red arrows.

Methods

Trout Population Estimates

Middle Clark Fork River mark-recapture estimates for trout were completed using a 20 ft aluminum jet boat, with 2 bow mounted boom anodes. Electrofishing occurred during daylight hours on the descending limb of the hydrograph within the June-early July period when flow and turbidity levels were appropriate for high capture efficiency. This timing corresponds with temperatures that are suitable for efficient captures and are still cool enough for reduced stress. The power from a 6,600 watt generator was routed through a Coffelt VVP rectifying unit that delivered typically about 375 volts to create an electrical field of 3-6 amperes. Our electrofishing crew typically consisted of three people, one driver and two netters on the bow. Fish were collected by sampling both banks in a downstream direction through the entire sampling reach.

Typically, we made between 1 and 3 marking, and 1 and 3 recapture electrofishing passes in order to estimate the density of trout in each river reach. Netters quickly removed all trout from the electrical field and placed them into a live well in the boat. We anesthetized all fish with clove bud oil, weighed (g), measured (mm) for total length (TL), and marked all trout 175 millimeters (mm) and greater with a fin punch unique to the survey reach.

We typically performed between two and three consecutive marking runs and would return approximately 5- 7 days following marking for between one and two consecutive recapture runs. This length of time between runs would allow for redistribution of fish within the section, and recovery form handling. The duration was not long enough that movement would violate the assumptions of a closed population. We aimed to recapture between 10 and 20% of our marked fish in our recapture runs to conduct a statistically valid estimate (Robson and Reiger 1964). We captured and collected all trout in the same manner, but did not mark any fish (replacement), and compared the number of marked fish to unmarked fish to achieve our estimates.

Population estimates (e.g., modified Peterson's estimator or log-likelihood estimators) were made using the mark/recapture population census methodology (Ricker 1975). We analyzed captures using R analysis software, and typically ran log likelihood or modified Peterson's estimators. As a supplemental evaluation, we also calculated the proportion of trout larger than 12 inches for each species during every sampling estimate event by simply taking the number of individuals with total lengths greater than 12 inches, divided by the total number of that species sampled during the population estimate.

Clark Fork River sampling reaches described in this report section include the 'Milltown' and 'Huson' sections. The Milltown section runs for 3.6 miles from immediately below the Blackfoot River confluence downstream to East Missoula (River Mile 212 to 208). The Huson Section includes the 3.7 river miles between the confluences of Sixmile Creek and Ninemile Creek (River Mile 177 to 173).

Estimates of Angling Pressure

Concurrent with fish population estimates, FWP collects angling pressure estimates and other metrics through standardized, state-wide mail surveys every two years. Relevant angling pressure estimates for the middle Clark Fork River are tabulated for two sections: (1) Rock Creek confluence to Bitterroot River confluence and (2) Bitterroot River confluence to Flathead River confluence. Pressure estimates for these two sections were combined to represent total angling pressure over time for the middle Clark Fork River fishery.

Results and Discussion

Trends in Angling Pressure

Total angling pressure increased somewhat during the 1989-2020 period, but the trend included significant variability for the middle Clark Fork River (Figure 2). Many environmental and social factors contributed to the long-term instability, but one primary environmental influence was the pronounced decrease in angler-days following the breach of Milltown Dam and subsequent site restoration (2007-2011). Removal of the dam and remediation work in the reservoir mobilized high levels of sediments and directly impacted fish populations and the middle Clark Fork fishery downstream. Short term impacts were obvious, but by 2017 the fishery and estimated levels of angling pressure rebounded and exceeded pre-project levels.

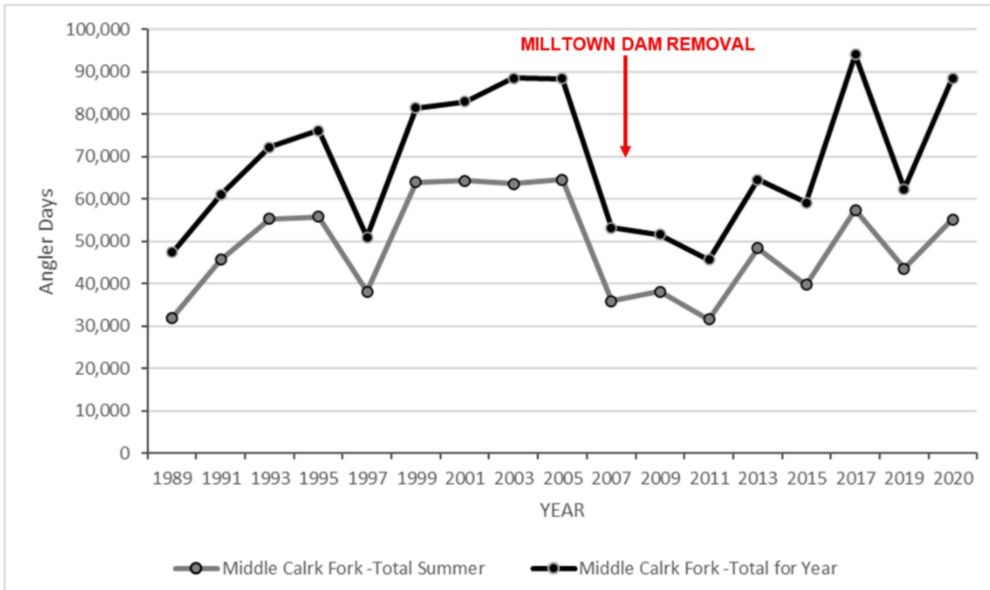

Figure 2. Summer and total annual angling pressure over time for the Middle Clark Fork River reach (Rock Cr to Flathead River confluence), with timing of Milltown Dam breach and removal noted.

Middle Clark Fork River Trout Fishery and Population Characteristics Over Time

The middle Clark Fork River supports a wild trout fishery comprised primarily of *Oncorhynchus* spp., where remaining native westslope cutthroat trout (WCT) populations supplement introduced rainbow trout (RBT) and RBT x WCT hybrids. Brown trout are also present, but make up a small percentage of the overall trout community in every sampling section. For instance, abundance estimates for trout ≥ 7 inches are segregated by species for the Milltown Section in Figure 5.

Total trout abundance in both population monitoring reaches was variable, but estimates generally oscillated between 200 and 600 catchable trout per mile for both sections (Figures 3 & 4). Many interacting environmental and biological factors contribute to the abundance of sub-adult and adult trout in these river reaches. Key factors include, but are not limited to, summer drought and water temperature extremes, winter ice conditions, spawning and juvenile rearing conditions in tributary streams, and major anthropogenic disturbances. In summary, abiotic influences create an unstable, and seasonally stressful, environment for salmonids in the middle Clark Fork River. Low overall trout carrying capacity and observed fluctuations in population abundance reflect this situation for the fishery.

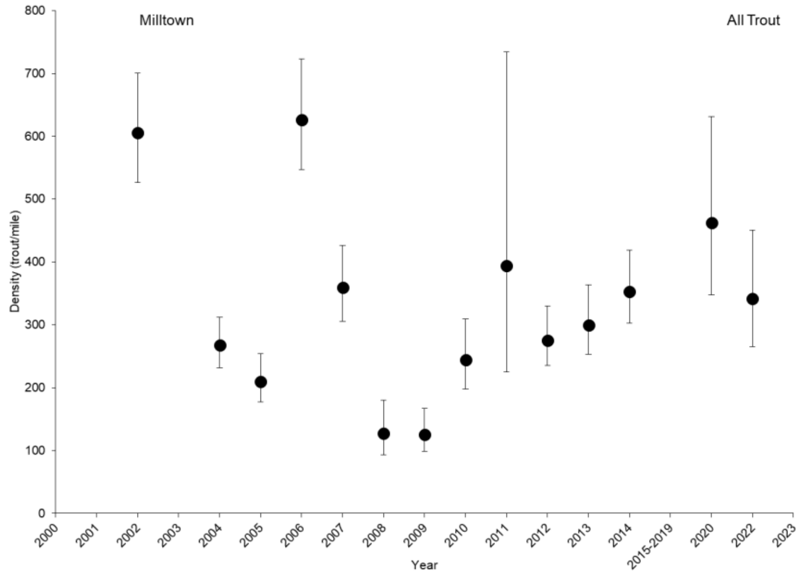

Figure 3. Population estimates for **all trout** (>7 in) the Clark Fork River **Milltown Section** over the past two decades.

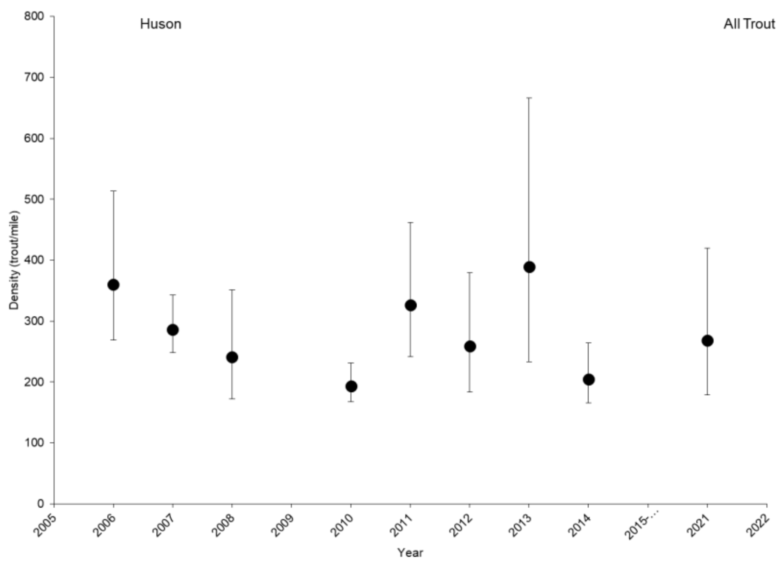

Figure 4. Population estimates for **all trout** (>7 in) the Clark Fork River **Huson Section** over the past two decades.

Acute impacts of Milltown Dam and Reservoir remediation were most pronounced on the fishery through the Missoula Valley and are best represented by trout population estimates in the Milltown section (Figure 3). Trout population abundance is inherently volatile in this reach and remediation work at Milltown added to this instability. Trout populations rebounded to pre-Milltown Dam removal levels concurrent with rebounding angling pressure (2011-2017), indicating angler pressure was not significantly constraining population growth. Trout population abundance remained low in the downstream Huson reach but was generally more stable over time (Figure 4). The addition of Bitterroot River water and its dilution effect on upper Clark Fork River contaminants likely contributes to trout population stability, although the impacts of Milltown Dam removal are still evident during the 2007-2011 time period.

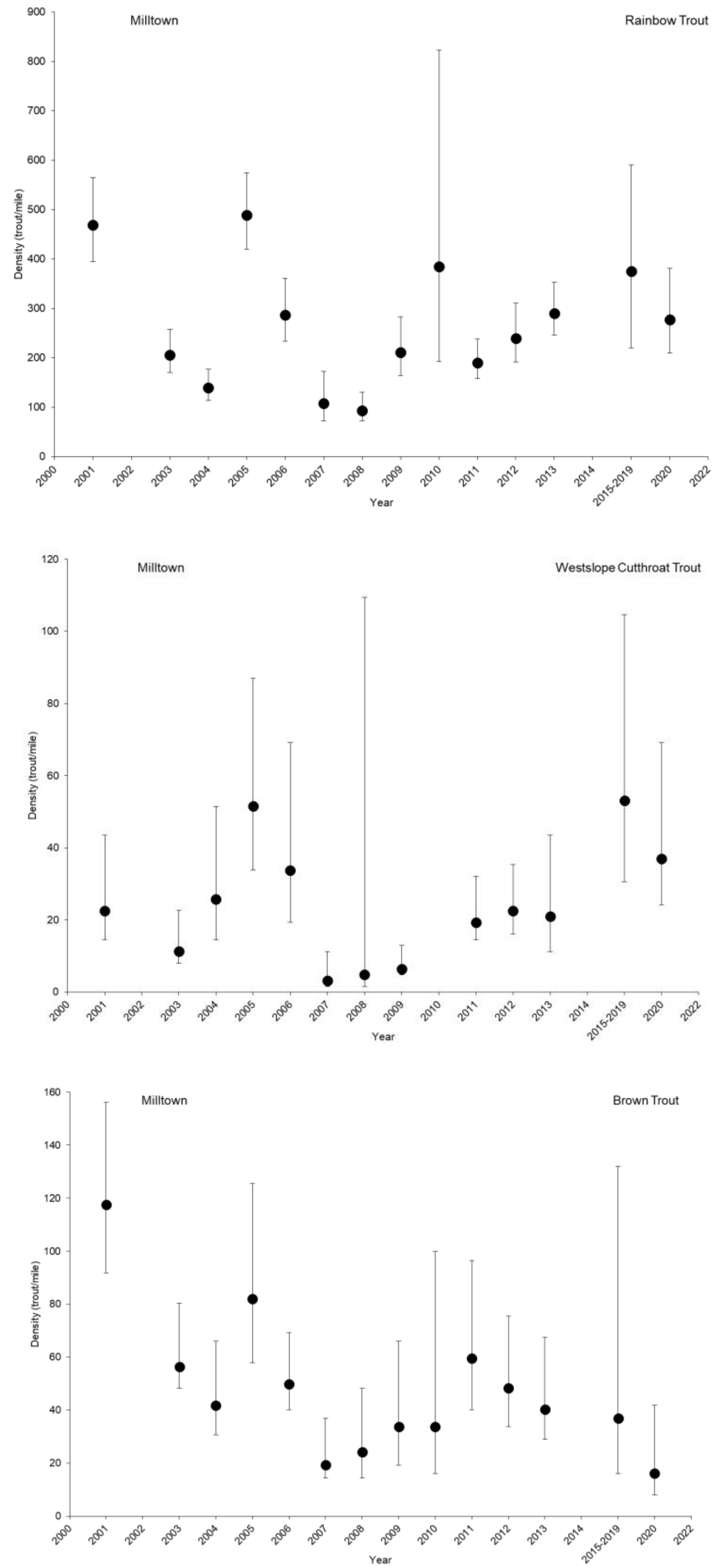

Figure 5. Population estimates for rainbow trout and Oncorhynchus spp. hybrids (top), westslope cutthroat trout (middle), and brown trout (bottom) over time in the Clark Fork River **Milltown section**.

Similar to trout population abundance estimates, there was no discernable trend or change in trout population size structure over time in the two Clark Fork River reaches. Figure 6 displays the proportion of captured trout that were larger than 12 inches for each sampling period over the past two decades. Although there were some differences in variation among species over time (e.g., WCT showed much more variation than RBT/Hybrids), no significant temporal trends were evident. In other words, trout size structure has been relatively stable in both sampling sections, despite temporal differences in abundance and major fluctuations in fishing pressure (Figure 1) and perceived shifts in angling methods over time.

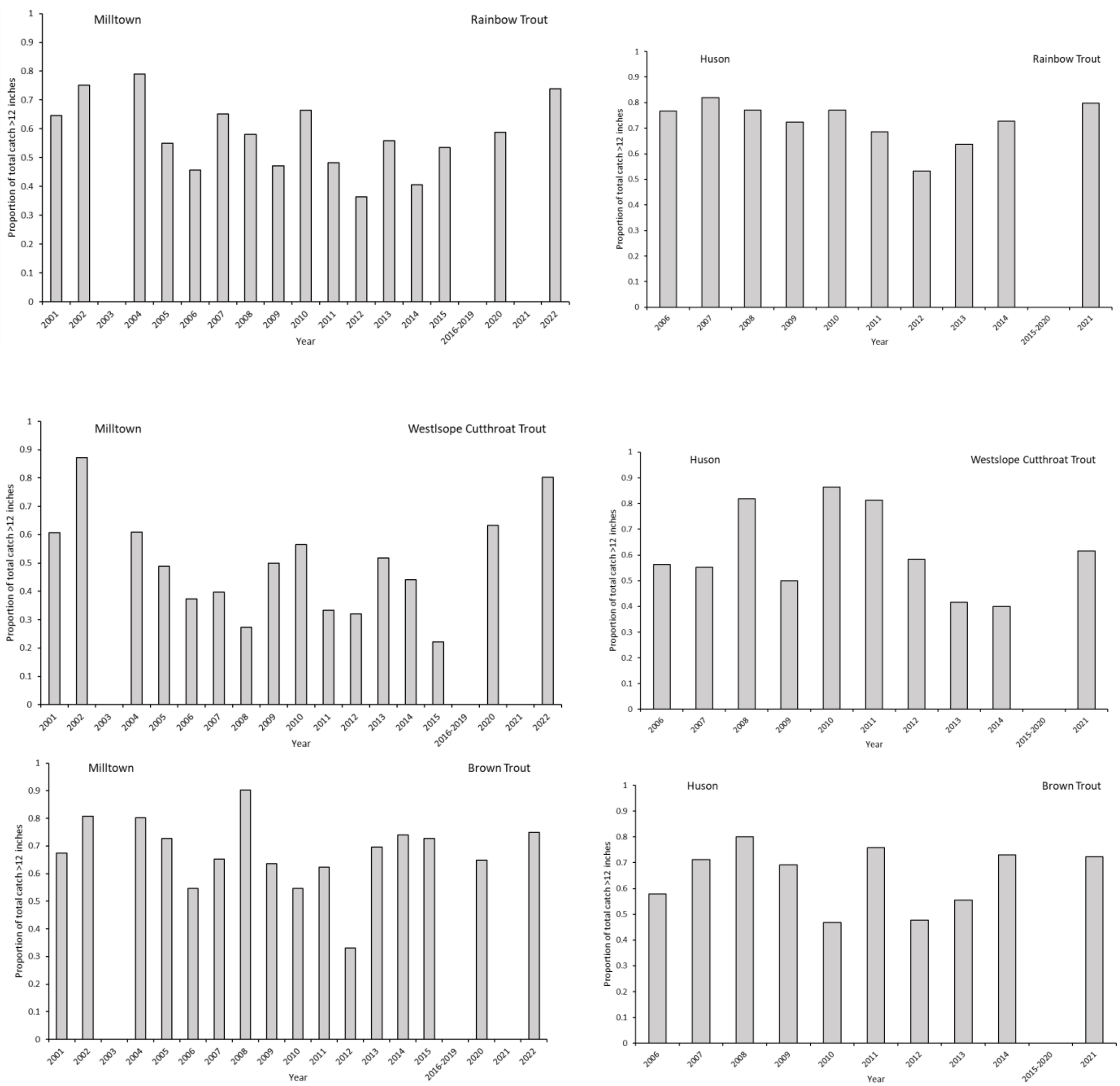

Figure 6. Proportion of trout greater than 12 inches for the **Milltown (left) and Huson (right)** population estimate sections on the middle Clark Fork River over time.

References

Knotek, W.L. 2003. Middle Clark Fork River Drainage Fisheries Investigations, 1999-2002. Federal Aid Progress Report, F-78-R6 and F-113-R1/R2. Montana Fish, Wildlife & parks, Missoula, Montana.

Knotek, W.L., 2004. Middle Clark Fork River and Missoula Area Fisheries Status Report. Montana Fish, Wildlife & Parks, Missoula, Montana.

Knotek, W.L. 2011. Statewide Fisheries Management - Middle Clark Fork Drainage. 2009-2011. Federal Aid Progress Report, F-113, Project 3240. Montana Fish, Wildlife & parks, Missoula, Montana.

Montana Statewide Angling Pressure Estimates. 1989-2020. Montana Fish, Wildlife & Parks, Helena, Montana.

Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Fisheries Research Board of Canada Bulletin 191.

Robson, D. S., and H. A. Reiger. 1964. Sample size in Peterson Mark-Recapture Experiments. Transactions of the American Fisheries Society 93 (3) 215-226.

Schmetterling, D. and R. Clark. 2014. Milltown Dam Removal Monitoring- Fisheries Investigations in 2013. Montana Fish, Wildlife & Parks, Missoula, Montana. Prepared for the Montana Department of Environmental Quality and the United States Environmental Protection Agency, Contract 406026. 46 pp.